



**CENTERIOR  
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July 7, 1996  
PY-CEI/NRR-2185L

United States Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555

Perry Nuclear Power Plant  
Docket No. 50-440  
LER 97-005

Ladies and Gentlemen:

Enclosed is Licensee Event Report 97-005, "Automatic Reactor Scram Following Auxiliary Transformer Trip."

If you have questions or require additional information, please contact  
Henry L. Hegrat, Manager - Regulatory Affairs at (216) 280-5606.

Very truly yours,

Lew W. Myers  
Vice President - Nuclear

DTG

Enclosure: LER 97-005

cc: NRC Region III Administrator  
NRC Resident Inspector  
NRC Project Manager

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# CATEGORY 1

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 9707140117      DOC. DATE: 97/07/07      NOTARIZED: NO      DOCKET #  
 FACIL: 50-440 Perry Nuclear Power Plant, Unit 1, Cleveland Electric      05000440  
 AUTH. NAME      AUTHOR AFFILIATION  
 HENDERSON, T.A.      Centerior Energy  
 MYERS, L.W.      Centerior Energy  
 RECIP. NAME      RECIPIENT AFFILIATION

SUBJECT: LER 97-005-00: on 970605, automatic reactor scram occurred.  
 Caused by missing piece of gasket matl. Extensive  
 investigation & evaluation efforts initiated. W/970707 ltr.

DISTRIBUTION CODE: IE22T      COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 6  
 TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

NOTES: Application for permit renewal filed. 05000440

	RECIPIENT ID CODE/NAME	COPIES LTTR ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR ENCL
	PD3-3 PD	1 1	HOPKINS, J	1 1
INTERNAL:	ACRS	1 1	AEOD/SPD/RAB	2 2
	AEOD/SPD/RRAB	1 1	FILE CENTER	1 1
	NRR/DE/ECGB	1 1	NRR/DE/EELB	1 1
	NRR/DE/EMEB	1 1	NRR/DRCH/HHFB	1 1
	NRR/DRCH/HICB	1 1	NRR/DRCH/HOLB	1 1
	NRR/DRCH/HQMB	1 1	NRR/DRPM/PECB	1 1
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EXTERNAL:	L ST LOBBY WARD	1 1	LITCO BRYCE, J H	1 1
	NOAC POORE, W.	1 1	NOAC QUEENER, DS	1 1
	NRC PDR	1 1	NUDOCS FULL TXT	1 1

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LICENSEE EVENT REPORT QUALITY ASSURANCE CHECK SHEET

LER NUMBER: 44097005

BATCH: 1099

STUDY: ES

PAGES: 5

TITLE: AUTOMATIC REACTOR SCRAM FOLLOWING AUXILIARY TRANSFORMER TRIP

EVENT DATE: 06/05/97

LER REVISION: 00

OTHER FACILITIES:

OPERATING MODE: 1

APPLICABLE CFR: M

POWER LEVEL: 100

AUTHOR: HENDERSON, T. A.

NPRDS REPORTABILITY

CAUSE

SYSTEM

COMPONENT

MANUFACTURER

NPRDS

CONTINUED:

SUPPLEMENT: N

SUPPLEMENT DATE:

QA BY:

QA DATE:

12

6/5/97

<b>NRC FORM 366</b> (4-95)		<b>U.S. NUCLEAR REGULATORY COMMISSION</b>		<b>APPROVED BY OMB NO. 3150-0104</b> <b>EXPIRES 04/30/98</b> <small>ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.</small>									
<div style="position: relative;"> <span style="position: absolute; top: -40px; left: -40px; font-size: 2em; transform: rotate(-45deg);">1099</span> <b>LICENSEE EVENT REPORT (LER)</b>          (See reverse for required number of digits/characters for each block)       </div>				<b>DOCKET NUMBER (2)</b> 05000440		<b>PAGE (3)</b> 1 OF 5							
<b>FACILITY NAME (1)</b> Perry Nuclear Power Plant, Unit 1													
<b>TITLE (4)</b> Automatic Reactor Scram Following Auxiliary Transformer Trip													
<b>EVENT DATE (5)</b>			<b>LER NUMBER (6)</b>			<b>REPORT DATE (7)</b>			<b>OTHER FACILITIES INVOLVED (8)</b>				
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER			
06	05	97	97	-- 005	-- 00	07	07	97	FACILITY NAME	DOCKET NUMBER			
									05000				
									05000				
<b>OPERATING MODE (9)</b> 1			<b>THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)</b>										
<b>POWER LEVEL (10)</b> 100			20.2201(b)			20.2203(a)(2)(v)			50.73(a)(2)(i)			50.73(a)(2)(viii)	
			20.2203(a)(1)			20.2203(a)(3)(ii)			50.73(a)(2)(ii)			50.73(a)(2)(x)	
			20.2203(a)(2)(i)			20.2203(a)(3)(iii)			50.73(a)(2)(iii)			73.71	
			20.2203(a)(2)(ii)			20.2203(a)(4)			X 50.73(a)(2)(iv)			OTHER	
			20.2203(a)(2)(iii)			50.36(c)(1)			50.73(a)(2)(v)			Specify in Abstract below or in NRC Form 366A	
20.2203(a)(2)(iv)			50.36(c)(2)			50.73(a)(2)(vii)							
<b>LICENSEE CONTACT FOR THIS LER (12)</b>													
<b>NAME</b> Todd A. Henderson, Supervisor - Compliance Unit								<b>TELEPHONE NUMBER (Include Area Code)</b> (216) 280-5889					
<b>COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)</b>													
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS			CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		
<b>SUPPLEMENTAL REPORT EXPECTED (14)</b>													
<b>YES</b> (If yes, complete EXPECTED SUBMISSION DATE).						X <b>NO</b>		<b>EXPECTED SUBMISSION</b>		MONTH	DAY	YEAR	
<b>ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)</b>													
<p>On June 5, 1997 at 1050 hours, the Perry Nuclear Power Plant (PNPP), Unit No. 1, was operating at 100 percent rated thermal power, when an automatic reactor scram occurred due to a 13.8 kV cable termination bus bar support fault at the auxiliary transformer, and subsequent auxiliary transformer phase differential relaying, generator lockout, turbine trip, and turbine control valve fast closure. The event was initiated when a three phase ground fault occurred on the 13.8 kV supply side termination compartment of the auxiliary transformer. It was determined the fault developed when electrical tracking established a conduction path across the 13.8 kV bus bar support/insulator to ground, apparently as a result of an accumulation of moisture and dust which entered the termination compartment housing at the location where a piece of gasket material was missing from the compartment housing sealing surface. Safety-related electrical loads were being supplied by the inservice start-up transformer. The nonsafety electrical loads automatically transferred to the start-up transformer, 200-PY-B, with the exception that the nonsafety bus that was locked out. This event had minimal safety significance since the safety-related loads were not affected, and the plant was stabilized within the bounds of plant operating procedures.</p> <p>The corrective actions for this event include: rework the 13.8 kV terminations and auxiliary transformer testing; periodic inspections of transformer termination compartments; additional training of transformer maintenance personnel; and, inspection/testing of protective relays for Unit 1 and Unit 2 startup transformers. This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv) as an automatic actuation of the Reactor Protection System.</p>													

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

## I. Introduction

On June 5, 1997, at 1050 hours, the Perry Nuclear Power Plant (PNPP), Unit No. 1, experienced a reactor scram as a result of a fault on a termination bus bar support in the 22 kV/13.8 kV auxiliary transformer [XFMR], 110-PY-B. Plant systems responded to the electrical fault in the following sequence: an auxiliary transformer phase differential signal; main generator lockout; turbine trip; and, turbine control valve fast closure which automatically initiated the reactor scram. This event is reported in accordance with 10 CFR 50.73(a)(2)(iv), as an automatic actuation of the Reactor Protection System (RPS) [JC]. The event was also reported at 1220 hours (ENF No. 32436) via the Emergency Notification System in accordance with 10 CFR 50.72(b)(2)(ii).

At the time of the event, the plant was in Mode 1 at 100 percent of rated thermal power. The reactor pressure vessel pressure was at approximately 1,024 psig with the reactor coolant at saturated conditions.

## II. Event Description

On June 5, 1997, the auxiliary transformer, 110-PY-B, was in a normal electrical configuration providing power to the plant's nonsafety loads, including 13.8 kV buses [BU] L11 and L12. No electrical work activities were being conducted at the time. Circuit breaker [52] L1202 connects interbus transformer LH-1-C to 13.8 kV bus L12, and breaker L1102 connects interbus transformer LH-1-B to 13.8 kV bus L11.

At 1050 hours, the control room received an unexpected automatic auxiliary transformer phase differential signal followed by: main generator lockout; turbine trip; and, turbine control valve fast closure resulting in an automatic reactor scram. Subsequent to the scram, as a result of the shutdown transient, a reactor high pressure scram signal was received. Following the plant shutdown, operators responded to a loss of power to nonsafety 13.8 kV bus L11 and associated 4160 V bus H11 due to a protective lockout signal. As a result, the operating Fuel Handling Building Ventilation (M40) system supply fan B tripped, the Control Room Ventilation (M25/M26) system transferred to emergency recirculation mode which resulted from loss of power to each system's respective radiation monitor, Source Range Monitors (SRMs) were declared inoperable and the Required Action statement of Technical Specification Section 3.3.1.2, "Control Rod Block Instrumentation," was entered. The plant operators responded by procedurally restoring power to buses L11 and H11 from the inservice start-up transformer, 200-PY-B. No further operator actions were necessary to stabilize the plant in hot shutdown conditions.



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## III. Cause

The event was initiated when a three phase ground fault occurred in the nonsafety 13.8 kV cable termination compartment of the auxiliary transformer. The fault was established when electrical tracking formed a conduction path across the 13.8 kV bus bar support/insulator to ground via the side walls of the termination compartment. It was determined that, initially, electrical tracking caused a conduction path to develop across the 13.8 kV bus bar support/insulator from the A phase cable termination to the bus bar support bracket (i.e., ground). As a result of the A phase ground, overheating and melting occurred which resulted in creation of various contaminants, including ionized air and soot. These contaminants resulted in an increase in the conductive properties of the equipment and atmosphere internal to the termination compartment, subsequently causing the B and C phases to begin arcing to ground. The transient caused the auxiliary transformer, 110-PY-B, to receive a phase differential signal that initiated the event.

The root cause was determined to be a missing piece of gasket material. The missing gasket material on the termination compartment housing allowed precipitation to collect in the compartment. After abnormal rainy weather conditions immediately followed by a period of hot weather, the postulated combined effects of the electrical tracking and the dust accumulation and condensation on the bus bar termination support/insulation system provided the initiating mechanism that allowed the ground to develop. The missing piece of gasket material may have been lost during work performed when replacing the Unit 1 auxiliary transformer with the Unit 2 auxiliary transformer following the auxiliary transformer failure event on May 30, 1996 (LER 96-005-00). The missing gasket material was a small spliced section, approximately two inches by two inches, located on the termination compartment.

Although a bus lockout was expected based on an actual fault condition existing on bus L12, it was later determined that the event was further complicated because bus L11 received the lockout signal instead of bus L12, which prevented automatic transfer of L11 to the start-up transformer, 200-PY-B. This condition was discovered during engineering review and troubleshooting conducted following the event. This error was determined to be the result of an original construction wiring error. The wiring error resulted in the protection relays for nonsafety buses L11 and L12 to be reversed. Consequently, the protection relays for bus L11 monitored the bus L12 feeder and vice versa. Therefore, after the fault occurred and had been cleared, bus L11 failed to automatically re-energize as designed.

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## IV. Safety Analysis

The event described in this report resulted in an actuation of the RPS. Plant safety systems functioned as designed with the exception that nonsafety bus L11 was locked out instead of bus L12. The lockout of nonsafety bus L11 resulted in the failure of L11 to re-energize which caused the operating Fuel Handling Building Ventilation (M40) system supply fan B to trip, the Control Room Ventilation (M25/M26) system to transfer to emergency recirculation mode which resulted from loss of power to each system's respective radiation monitor, and loss of power to SRMs. The plant operators responded by declaring the SRMs inoperable, entered the Required Action statement of Technical Specification Section 3.3.1.2, "Control Rod Block Instrumentation," and by procedurally restoring power to 13.8 kV bus L11 and it's respective 4160 V bus H11 from the inservice start-up transformer, 200-PY-B. The shutdown was performed within the bounds of normal operating procedures. No further operator actions were necessary to stabilize the plant in hot shutdown conditions. At no time was there an interruption of power to safety-related plant equipment. The sudden loss of electrical load, as seen by the reactor, was well within the bounding analyses of the Updated Safety Analysis Report. Therefore, this event had minimal safety significance.

## V. Similar Events

LER 96-005-00 documents an event in which an automatic reactor scram occurred following an auxiliary transformer failure. The event was caused by an apparent design and/or assembly practices that existed when the transformer was manufactured. The cause and corrective actions from this event were directed toward evaluation of whether the Unit 2 replacement auxiliary transformer was adversely affected by the manufacturing design and/or assembly practices that resulted in the unit 1 auxiliary transformer failure. The work activities associated with the replacement of the auxiliary transformer could have been related to this event. However, the corrective actions for the 1996 event are such that they could not reasonably have been expected to prevent the 1997 situation from occurring.

## VI. Corrective Actions

Extensive investigation and evaluation efforts were initiated: repairs were made to the 13.8 kV bus bar terminations and gaskets were verified to have proper integrity; auxiliary transformer testing was conducted which determined that internal damage had not occurred; and, protective relays for buses L11 and L12 were corrected to properly sense their respective feeders. Inspection of the auxiliary and other related transformer termination compartments will be conducted on an increased frequency. Transformer maintenance personnel will receive the appropriate training to ensure adequate attention to detail is applied to work activities to ensure electrical equipment is protected from environmental effects. Additional inspection and testing of protective relaying on Unit 1 and Unit 2 startup transformers is being planned.

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Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

The following table identifies those actions which are considered to be regulatory commitments. Any other actions discussed in this document represent intended or planned actions, are described for the NRC's information, and are not regulatory commitments. Please notify the Manager-Regulatory Affairs at the Perry Nuclear Power Plant of any questions regarding this document or any associated regulatory commitments.

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Commitments

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1. Repetitive tasks will be established by August 15, 1997, to ensure inspections of the auxiliary and other related transformer termination compartments occur at the appropriate frequencies.
2. Transformer maintenance personnel will receive the appropriate training to ensure adequate attention to detail is applied to work activities to ensure electrical equipment is protected from environmental effects by August 15, 1997.